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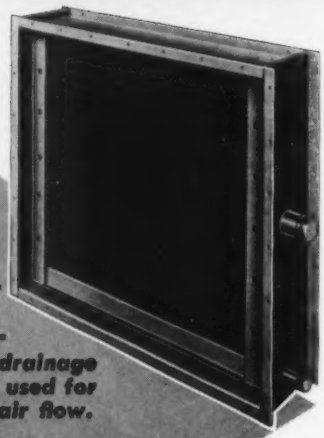
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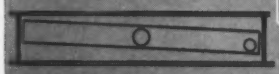
ifty Years of Refractory Metals . . . . . Page 8
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SPS Listings . . . . . Page 25

December, 1960
Vol. 13, No. 4

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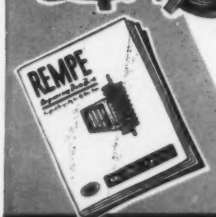
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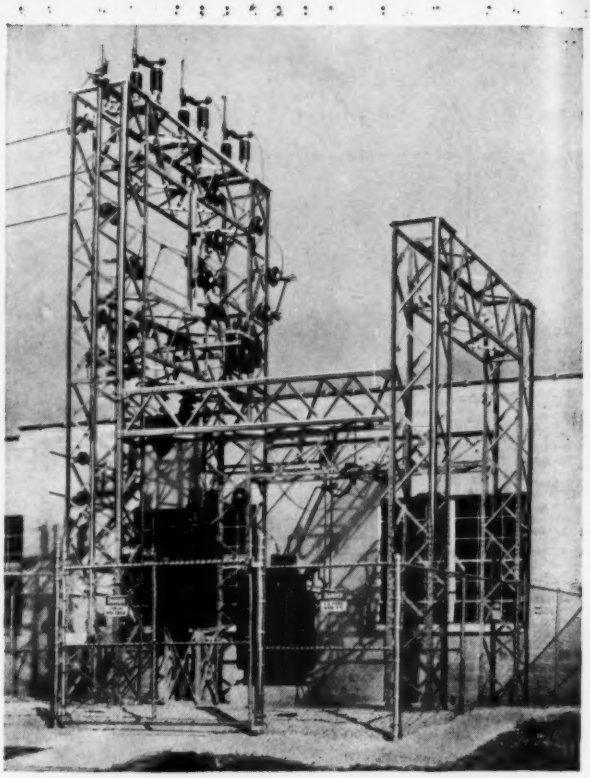
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An "Electronic Democracy"

An "electronic democracy" with network systems enabling American citizens to vote directly on bills before Congress could be one result of the new technology of the 1960s, a Hughes Aircraft Company economist has suggested.

But Americans, in their easy chairs, would have to devote several hours a week to true self-government in the Town Hall tradition by hearing legislative bills read on the floor of Congress, listening to the debates and even taking part in the discussion—all by means of two-way TV, Stahrl W. Edmunds, Hughes manager of market analysis, said.

Then they actually could cast their ballots through a home voting transmitter tied into a central broadcast, control and data processing center, he told a meeting of the California Loan and Finance Association at the Beverly Hilton hotel.

He said the predicted boom of the "soaring sixties" will depend largely on consumer acceptance of new electronic technology. This, he said, will not deliver its economic impact in the development of martini coolers or other gadgets, but in systems adapted, for example, from giant missiles, and which would apply to entire areas of day-to-day living.

Edmunds said the "electronic referendum" is one of the more fanciful possibilities of the new decade's technology. In the same category, he also visualized:

1. An "electronic chef" which, with the help of a computer's memory for recipes, could duplicate the most succulent dishes of Antoine's or Maxime's.

2. An automatic budgeteer that would enable a housewife to pay all bills through her bank by inserting a punch card into a scanning machine attached to her telephone line. It would even flash a red light when she is spending more than her budget can stand.

He listed several Hughes achievements as examples of the new technology which already are realities. The Mobot remote control machine to perform tasks in areas or under conditions too dangerous for man; a numerical machine tool control that performs complex machining operations automatically; and videosonics, and audio-visual instruction systems that show how to assemble complex equipment and increase man's ability to learn languages, mathematics and other sciences.

While some consumers may expect the new technology to produce items like a handy martini cooler, he said, many industry scientists are working in the broad field of cryogenics (the science of producing extremely cold temperatures) to make radar detect missiles at greater distances than ever before.

"Technology is not basically going to bring a lot of incidentals into the consumer's home," he said. "When the new technology comes into the home, it is not going to bring the martini cooler but some adaptation of the whole roaring missile system itself."

Edmunds listed four major forces that "will determine the extent of the economic boom of the 1960s": (1) the population expansion, (2) international competition, (3) the rapid technological advances of the U.S. and (4) the rate of customer acceptance of technical change.

Defining international competition as "worldwide competition of free economies versus regimented economies," Edmunds said that "this economic competition, and not war, will ultimately decide the balance or power between the East and the West."

"The deciding factor in the competition, in my judgment, will be the ability to capture the imagination of men, not by growth rates but by the vision of a brave new world," he said.

Midwest Engineer

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Calendar of Chicago Engineering

—DEC. 21, WED., WSE Civic Committee Dinner (6:15 p.m.) and Meeting. At WSE Hq.

—DEC. 21, WED., NO WSE NOON LUNCHEON MEETING because of proximity to CHRISTMAS.

—DEC. 28, WED., NO WSE NOON LUNCHEON MEETING because of proximity to NEW YEAR'S.

—JAN. 4, WED., WSE Noon Luncheon Meeting (12:00 noon). At WSE Hq.

—JAN. 11, WED., WSE Noon Luncheon Meeting (12:00 noon). at WSE Hq.

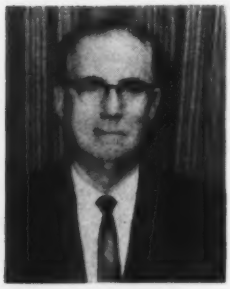
—JAN. 18, WED., WSE Civic Committee Dinner (6:15 p.m.) and Meeting. At WSE Hq.

—JAN. 18, WED., WSE Noon Luncheon Meeting (12:00 noon). At WSE Hq.

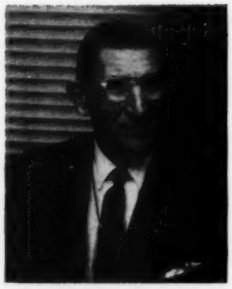
—JAN. 24, TUES., WSE General Meeting and Dinner. Social Hour (5:15-6:15 p.m.) Dinner (6:15). Dinner Speaker (7:15-7:45). Technical Sessions (8:00). At WSE Hq.

—JAN. 25, WED. NO WSE NOON LUNCHEON MEETING. Reserved for ASME.

At the Speakers' Table — at:



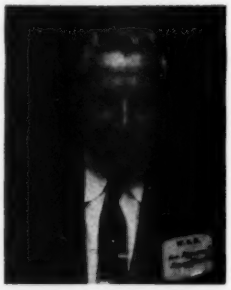
Howard A. Carter
WSE Program Chairman for 1960-61; Partner in the firm of Carter and Holmquest Technical Service.



John Gottselig
Speaker for the Dinner Program; Publicity Representative Chicago Black Hawks.



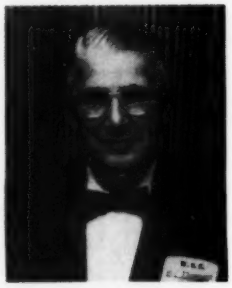
Daniel E. Clark
Chairman of Communications Section; Director of Research, Automatic Electric Laboratories.



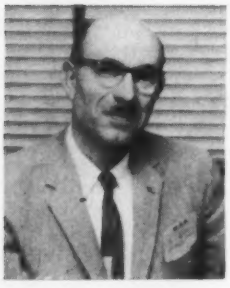
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WSE Trustee; Chief Structural Engineer and Partner with Sargent & Lundy.



Carl A. Metz
WSE Trustee; Partner in the firm of Shaw Metz & Associates.



E. L. Durkee
Speaker at Technical Session No. 1; Engineer of Erection, Bethlehem Steel Company.



Joseph N. Petrie
Speaker at Technical Session No. 2; Chief Transmission Engineer, Automatic Electric Company.



T. W. Spilman
District Engineer, Bethlehem Steel Company.



George L. Heminger
Planning Engineer, Western Electric Company.



A. P. Arndt
Senior Designer, American Bridge Division of U.S. Steel Company.

WSE's General Meeting of Nov. 22

The Western Society's General Meeting of November 22 included:

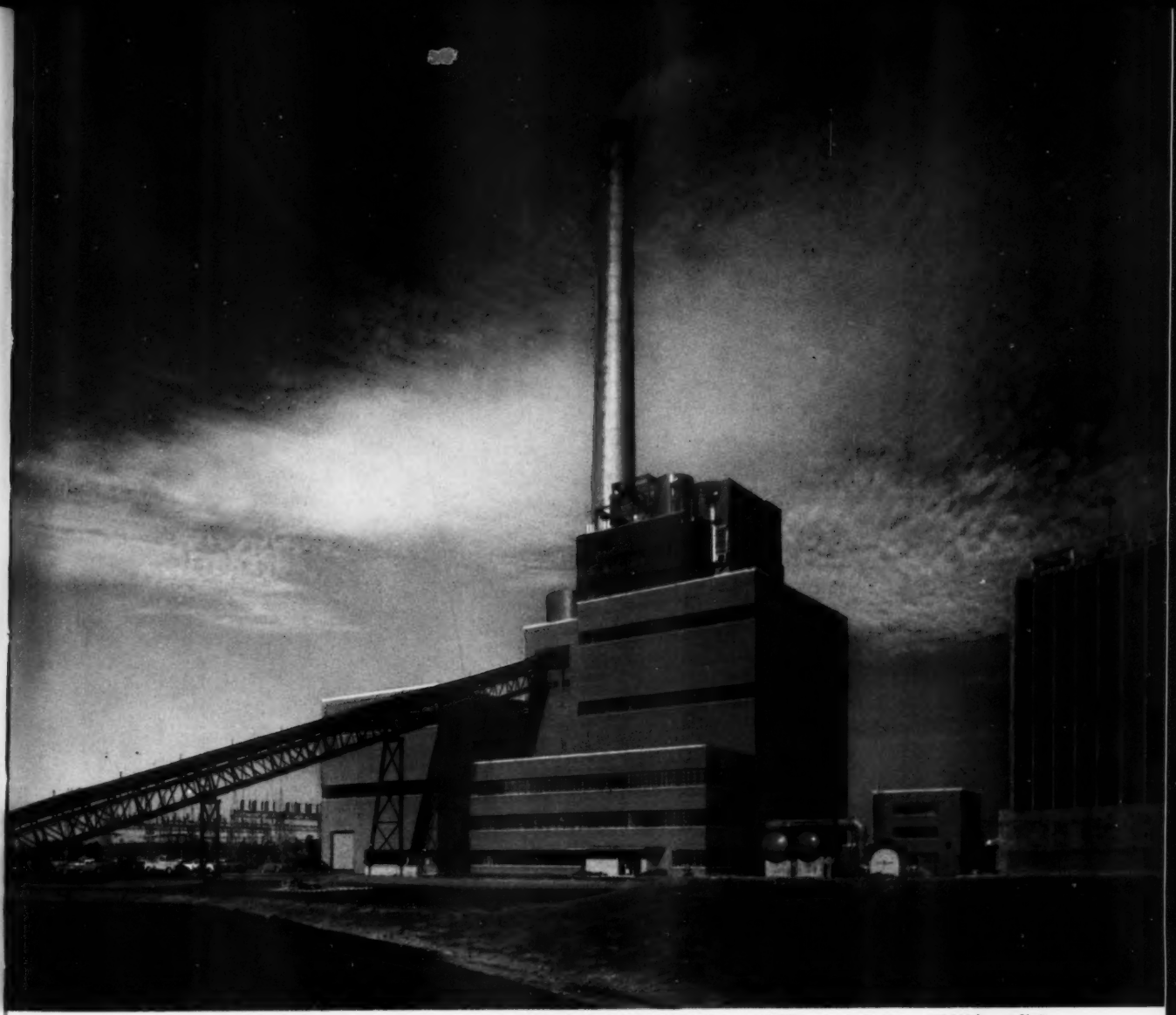
Complimentary Social Hour, 5:15-6:15 p.m.

Dinner, 6:15 p.m.

Dinner Program, 7:15-7:45 p.m. "Hockey and The Chicago Black Hawks." John Gottselig, Publicity Representative of the Black Hawks Hockey Team told of some of the high spots of this great sport, and gave the low down on the Chicago team.

Technical Session No. 1, 8:00-9:00 p.m. "Remodeling the George Washington Bridge." This famous bridge had a face lifting this spring. Mr. E. L. Durkee, Engineer of Erection, Bethlehem Steel Company, discussed the many unusual erection features used in remodeling this bridge. He illustrated his talk with color slides. Sponsor, Bridge and Structural Engineering Section, Richard N. Bergstrom, Chairman.

Technical Session No. 2, 8:00-9:00 p.m. "Elements of Transmission Design in Local Telephone Plants." The speaker was Mr. Joseph N. Petrie, Chief Transmission Engineer, Automatic Electric Company, a veteran of 30 years of distinctive service in this field. Mr. Petrie is presently chairman of the Wire Communications Systems Committee of the American Institute of Electrical Engineers. Sponsor, Communications Engineering Section, Daniel E. Clark, Chairman.



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The unbroken whiteness of the end wall is in striking contrast to bright, blue-green spandrel panels of the sidewalls. And on the broad base wall below, light and shadow form bold patterns across the sculptured facing. 42 stories, and the tallest office building in the West, the Southland Life Tower is part of a $35,000,000 project in downtown Dallas, Texas.

It's all done with concrete panels. For the end walls and base, exposed quartz aggregate and white portland cement give surface roughness and brilliance. The smooth-faced spandrels are vitreous tile cast in concrete. The total effect is one more example of the unlimited design possibilities in today's new forms of concrete.

Architects and Engineers: Welton Becket, FAIA, and Associates, Los Angeles and Dallas. Consulting Architect: Mark Lemmon, AIA, Dallas, Texas. Structural Engineers: Murray Erick Associates, Los Angeles.

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NONFERROUS NEWS

An advanced process for electroplating a coating of sulfur-free, semi-bright nickel on metal surfaces has been announced by The Udylite Corporation, world's largest supplier of metal finishing equipment and supplies. The process is expected to reduce costs and improve the appearance and durability of electroplated finishes on automotive parts, appliances, and other metal products.

The new process, designated N2E by Udylite, is an important advance in the plating industry because of its extreme simplicity of operation, consistent uniformity of coating appearance, ease of control, and economical use of continuous filtration with activated carbon.

"One of the basic advantages of N2E over other semi-bright nickel processes," says L. V. Nagle, executive vice president of Udylite, "is the lack of harmful breakdown products. These are organic materials that have been oxidized or reduced through the process of plating which may lead to a higher rejection rate.

The new process, covered by patents granted to The Udylite Research Corporation, a subsidiary of The Udylite Corporation, involves the simultaneous addition to the electroplating bath of two Udylite addition agents, Brightener E and Brightener 2N. From the combination comes the name of the new process, N2E.

The semi-bright nickel coating is unusually receptive to subsequent bright nickel deposits, such as the Udylite #66 Bright Nickel process. This combination, with a final chromium plate, has proved to be extremely satisfactory in prolonging service life in corrosive environments.

♦

A new aluminum-coated steel wire has been developed by National-Standard Company, according to Thomas H. Pearce, president. Called "Alstan," the wire is produced by an exclusive process developed by National-Standard's research and engineering staff. Several patent applications have been filed on the new process.

"Alstan, made with electrically conductive aluminum, is expected to complement National-Standard's Copperply copper-coated steel wire in the communications field," says Mr. Pearce. "We expect to find applications in other fields where strength, electrical conductivity and corrosion resistance—or a combination of these properties—are required. Power transmission, for example, could offer a broad market for Alstan."

A solid phase bond is established between the aluminum and steel that permits drawing and fabricating. Alstan has been produced with an aluminum coating of 20 to 60 per cent of total cross sectional area. This gives electrical conductivity of 20 to 40 per cent of equivalent sizes of copper wire. An even wider range of coating thickness may be practical.

Pilot production of Alstan has been started, and limited quantities are now available in a range of wire sizes. The unique process permits a broad range of wire diameters, strengths, and coating thicknesses.

♦

Vincent D. Perry, vice-president and chief geologist of The Anaconda Company, has been named by the Society of Mining Engineers as the 1961 recipient of its Jackling Award and as the Jackling Lecturer. The Society is a constituent organization of the American Institute of Mining, Metallurgical and Petroleum Engineers.

Presentation of the award, to be followed by the Lecture, will be before the Mining and Exploration Division of the Society of Mining Engineers, on March 1, 1961 during the AIME Annual Meeting, to be held Feb. 26-Mar. 2 in St. Louis.

In designating Mr. Perry for the honor, the SME Board of Directors voted the following citation:

"For his contributions to geology and geophysics; his leadership in their application to the finding and developing of mines, and for his lecture."

Mr. Perry was born in San Francisco. He acquired his mining ambitions during vacations, as a lad, in mining camps of the California Motor Lode and in Nevada. He was graduated from the University of California at Berkeley in 1922 with a B.S. in mining engineering. He started work with Carson Hill Gold Mines, Inc., at Melones, Calif., then went to the Columbia University, where he received his Master's degree in mining engineering in 1924. Mr. Perry then entered upon his career with The Anaconda Co. He engaged in extensive geological mapping at Butte, Mont., and in 1928 was transferred to Cananea Consolidated Copper Co., an Anaconda subsidiary in Mexico.

His mapping of the great orebody there contributed largely to the systematic exploration of the area. In 1937, Mr. Perry was transferred to Anaconda Copper Mining Co. as exploration geologist with headquarters in Los Angeles. In 1939 he moved to the company's Salt Lake City office and in 1944 was appointed chief geologist for International Smelting & Refining Co., an Anaconda subsidiary. The following year he became assistant chief geologist for Anaconda Copper Mining Co. In 1948 he was made chief geologist of The Anaconda Co., with headquarters in New York City.

Mr. Perry is a vice-president of The Anaconda Co. (Canada) Ltd. and is a director of that company and of Green Cananea Copper Co., Golden Reward Mining Co., and Santiago Mining Co. He is a member of Tau Beta Pi, honorary engineering fraternity, and Sigma Xi, honorary scientific fraternity. He has been a member of AIME since 1924.

The Jackling Award winner has been intimately associated with the Yerington open pit copper mine in Nevada; the Grants, New Mexico, uranium operation; the Berkeley pit at Butte; the El Salvador copper mine in Chile; the Nakina iron ore deposit in Ontario; and the Bathurst zinc deposit of New Brunswick. He has been closely concerned with the modern geological developments at Cananea, Mexico, and Chuquicamata, Chile.

The Daniel C. Jackling Award and Lecture were established in 1953 in honor of Daniel Cowan Jackling, an Honorary Member and former President of AIME and pioneer in the mining and treatment of the porphory copper ores. Its presentation is, basically, for "significant contributions to technical progress in the fields of mining, geology, and geophysics."

Mr. Jackling was also a member of the Western Society of Engineers.

Fifty Years of

REFRACTORY METALS

By L. F. Yntema
Allan L. Percy

The refractory metals are generally defined as those having melting points higher than 2000°C (3600°F). Of this group, the metals which have come into most active commercial use are tantalum, tungsten, molybdenum, and columbium.* All four of these metals are made in pure form, and in certain non-ferrous alloys, by the company with which the authors are associated.

The commercial use of the refractory metals began about 50 years ago. Their distinctive properties, in particular, high melting points and low vapor pressures, were employed in the use of tantalum, then tungsten, as filament material in incandescent lamps. The development of the vacuum tube added to these uses, and included molybdenum. In fact, the development of the science of electronics and of wireless was in large measure based on the availability of these metals.

All technology can be placed in two rather distinct categories. One comprises the ancient arts that were practiced without an understanding of the chemistry and physics involved. Paper making, glass making, and the metallurgy of copper are cases in point. The second category includes the technology which depends upon precise laboratory work. The manufacture of soda from salt, the making of artificial dyes, of synthetic textile fibres, and the processing of the refractory metals are examples.

Some of the problems in the metallurgy of these metals are unique in that they are not encountered in the metallurgy of the lower melting, less reactive metals. The melting points are so high that no refractories will serve as crucible material for the molten metal. Graphite might be used except for its reactivity with the metals. Another consideration is that these metals will react with oxygen at temperatures below red heat. Therefore all heating must be done in a protective atmosphere. Hydrogen or "cracked" ammonia may be used for molybdenum or tungsten, but for columbium or tantalum, the noble gases or a vacuum are necessary.

The product of reduction operations

*Other metals of the refractory group are boron, hafnium, ruthenium, iridium, osmium, and rhenium.

is always a metal powder. It is not technically feasible to carry out the reaction at a temperature high enough to produce molten metal because of lack of suitable materials of construction and tremendous power requirements. The techniques of powder metallurgy are used to convert these metals into massive form. The powder is compacted into a shape, usually a bar, and the mass is then heated by passage of an electric current, by radiation, or by induction, to a temperature about 200 degrees below the melting point. This operation is called *sintering*. The ingot, now having a density over 90 per cent of that of massive metal, is further compacted by working.

The energy available for sintering determines the cross section of a bar that can be heated by direct passage of current. One square inch of cross section requires about 10,000 amperes. A major subject of interest during the last few years has been the production of ingots of much larger cross section by arc melting. This process is not new; it was used by von Bolton to produce tantalum at the turn of the century.

The process consists of striking an arc between a sintered bar of the metal and pieces of the metal laying on a water-cooled copper plate, or in a water-cooled copper mold—in a vacuum, of course. The heat of the arc melts the bar and a pool of metal is collected. Since the metal next to the copper is immediately solidified, a container of the metal itself is formed. This is a type of skull melting operation.

The ores of these metals cannot be called abundant; yet the metals cannot truly be called "rare metals." Each of them is produced in large commercial quantities; each is produced on a competitive scale by more than one manufacturer.

TANTALUM

In 1907, fifty years ago, all four of the elements were known; indeed three of them had already been made into metal of varying degrees of purity. But the only one that had achieved anything like commercial production was tantalum. Von Bolton, in the Siemens-Halske plant in Berlin, produced small pellets of tantalum of sufficiently high purity and ductility to permit working into sheet and wire. Tantalum became the first metallic lamp filament, and until it was replaced by tungsten, some 11 million tantalum lamps were made in Europe and the United States. Dental and surgical instruments with non-corroding tantalum blades or tips were also produced. European production of tantalum ended, however, when the onset of World War I cut off the Australian ore supply.

Clarence W. Balke, then director of research for Fansteel Metallurgical Corporation, produced pure ductile tantalum bars by powder metallurgy in 1922. (Von Bolton's pellets had been arc melted.) His "ingot" was about the size of a kitchen match. Methods of forming and welding the metal were still to be discovered, but the metal was pure and ductile, easily rolled into strip, or drawn into wire. Seeking a use which could be made of such small pieces, Balke found that a strip of tantalum and a piece of lead, immersed in a jar of sulfuric acid electrolyte, made an excellent rectifier. At this time, radio receivers were operated by direct current, which made a good market for Fansteel-Balkite battery chargers and "B" power supplies.

This market, unfortunately, lasted only a few years, and when the a-c receiving tube came into the picture, the rectifier went out. In the meantime, however, larger models of the tantalum rectifier found uses in railway signal systems, where the rectifier supplies low voltage d-c power to operate the signal equipment and charge the standby storage battery. Despite the development of smaller "dry plate" metallic rectifiers, a good many thousands of these rectifiers are still in use, and more are sold each year.

In the meantime, new uses for tantalum were being explored, larger ingots were being made, methods of fabricating and welding the metal were being developed.

Tantalum's most remarkable property is probably its almost complete immunity to chemical attack. Its resistance to corrosion is approximately the same as that of glass, yet it has none of the disadvantages. Tantalum appeared to be a most attractive material of construction for chemical processing equipment for use under conditions of extreme acid corrosion.

The first use of tantalum in this field was in 1923 when a number of diaphragms were fabricated for use in apparatus for metering chlorine into the water supply of the City of Chicago.

Recognition came slowly. Chemical engineers of that time, accustomed to massive, heavy equipment of stoneware, lead, glass, or cast iron, could hardly be blamed for skepticism when confronted with sheet metal construction. But a few courageous ones tried tantalum, mainly because they were in desperate need of equipment that would not introduce contamination into a drug, dye or fine chemical product.

The turning point came in 1935 when a large heat exchanger was built for the synthesis of ammonium chloride, the active material in dry cell batteries. Tantalum ended a severe contamination problem, and made it possible for the first time to stamp life dates on flashlight batteries. This old heat exchanger, by the way, is still in service as this paper is written.

Word got around, more tantalum equipment was built and sold—heating coils, evaporators, stills, condensers. In 1937, Fansteel built the first tantalum hydrochloric acid absorption plant for Monsanto Chemical Company. Five years later, upward of 80 per cent of HCl produced in the United States was made in tantalum equipment.

As early as 1926, it was discovered that tantalum is a valuable material in electronic tubes. When heated, it absorbs the gases left in the tubes after exhausting, or released by other materials, thus helping to maintain the high vacuum necessary for good operation. In addition, tantalum has the

This paper, by L. F. Yntema and Allan L. Percy, Fansteel Metallurgical Corporation, North Chicago, Illinois, was presented at 132nd National Meeting, American Chemical Society, New York, September 11, 1957, and is published with the permission of the Society.

necessary high melting point and, compared with other metals used in tubes, is very easily fabricated. The only disadvantage is relatively high cost. A few tube manufacturers began to use tantalum, and by 1940 practically every tube maker was using tantalum parts in at least some tubes.

During World War II, millions of tubes with tantalum parts were made for the armed services. Tantalum continues to be used in many types of tubes, but designs of tubes tending toward miniaturization diminish the amount of tantalum used in an individual tube. The electronic tube industry nevertheless is still an important market for tantalum.

Surgeons have used metal implants for repairs in the human body since ancient times. Unfortunately, reactions of body chemicals with these metals must have caused disturbances which offset any good done by the surgery. In recent years, alloys harmless to the body have been developed, but surgeons were still hoping for a perfectly passive metal, ductile and pliable, which could be cut, shaped, and formed at the operating table.

In 1937, experiments with tantalum were found to be successful. Papers began to appear in the professional journals, and by the time the wounded of World War II were brought into hospitals, tantalum had become firmly established. Holes in skulls were covered with tantalum plates. Served nerves were joined with tantalum wire and wrapped in tantalum foil. Artificial ears were made with grafted skin over tantalum framework. Missing pieces of jawbone were replaced with tantalum rod and tubing. And for sutures, tantalum wire was used almost by the mile.

During the war, the distribution and sale of tantalum products for surgery was turned over to Ethicon, Inc., a subsidiary of Johnson & Johnson. This well-known and respected surgical supply house has done admirable work in making tantalum known to surgeons throughout the world, and in developing new uses of the metal for surgeons.

Perhaps the most important use of tantalum today, as far as volume is concerned, is in tantalum capacitors. Compared with other metals, tantalum is unusually stable chemically and electrically. The tantalum oxide film, which is the essential part of the capacitor, has a higher dielectric constant than any other known material. Fansteel made a few tantalum capacitors for telephone service as early as 1930. These were made from tantalum sheet which then cost about 45 cents per square inch, which discouraged extensive applications.

A few years later, it was discovered that tantalum metal powder could be compacted into porous pellets which would serve as capacitor electrodes at much lower cost. This idea was put to use in a capacitor-type arrester for railway signal equipment, and many thousands have been put into use. At the same time, other applications for tantalum capacitors were explored.

War work set this aside temporarily, but in 1949 interest was revived by the Bell Telephone Laboratories, who needed a 4 microfarad capacitor of a very small size with a life expectancy of 30 years. Fansteel developed a model which was approved and put into commercial production. The development of the transistor brought about a need for associated components of similarly small size, and the tantalum capacitor has proved to be a natural companion to the transistor in most of its applications.

In the meantime, other capacitor manufacturers were developing tantalum capacitors, some using porous powder metal electrodes, some using rolled tantalum foil. Fansteel supplies tantalum and technical assistance to these manufacturers.

TUNGSTEN

Tungsten is the oldest of our refractory metals, and probably the best known. It dates back to the 18th Century when Scheele identified it and the brothers de Elhuyer made the metal by carbon reduction of the oxide.

No use for pure tungsten was developed, however, until 1909 when W. D. Coolidge made the first tungsten lamp filaments. Fansteel began making tungsten in 1914 for use as electrical contacts in the automobile ignition systems which the company then manufactured. With its high melting point (the highest of all metals) and good mechanical strength and hardness, tungsten has proved to be an excellent material for electrical contacts, not only in automobiles but in a great number of electrical devices. Tungsten-copper and tungsten-silver compositions, made by powder metallurgy, are used for electrical contacts in circuit breakers, motor starters and other heavy duty switchgear. The presence of copper or silver improves conductivity and minimizes heating effects when circuits are closed, and the tungsten imparts resistance to arc erosion when the circuit is opened.

Tungsten is used in anodes or targets in X-ray tubes. The short wave length characteristics of the tungsten X-ray, as determined by its atomic number, give it high penetration. The high melting point and low vapor pressure of tungsten make possible a high concentration of energy at the focal point of the target. It is common practice to increase this energy even further by mounting the tungsten target in a water-cooled copper block, or on a molybdenum or tantalum shaft which rotates the target rapidly when the tube is in use.

In electronic tubes, tungsten is used for filaments and heaters. The pure metal has good emissive properties, and these are sometimes augmented by the addition of thorium. Tungsten wire and rod are also used for seals through glass. The metal has almost the same coefficient of expansion as the "hard" borosilicate glass used in many types of tubes.

Tungsten electrodes are used to sustain the arc in inert gas arc welding. Because of its high melting point, the electrode is consumed very slowly and the vapor causes no serious contamination in the weld area.

These same properties of tungsten are useful in applying vapor-deposited coatings in vacuum. The coating material—aluminum, in the case of mirrors, headlights or reflecting surfaces of television tubes—is applied to a coil of tungsten wire. When the wire is heated, the aluminum is vaporized and condenses as a thin, smooth coating on the surface of the work.

Tungsten is one of the heaviest of all metals—almost 2½ times as heavy as steel, almost twice as heavy as lead. This property, coupled with high strength, makes tungsten a very desirable material for uses where high density is required in small space. Such uses include high-speed rotors for gyroscopes and navigational instruments, balance weights, vibration damping devices, and shields for radioactive materials.

Simple shapes are made from pure tungsten, but where finish machining, drilling or tapping are required, machin-

able alloys containing small amounts of nickel and copper are commonly used. Most modern aircraft have rudders and ailerons counterweighted with tungsten alloys to prevent vibration and flutter.

The story of tungsten carbide is so well known that it needs no repetition here, but it certainly is significant in 50 years of refractory metals. In 1930, tungsten carbide tool tips were almost as expensive as platinum. Today, tungsten carbide tools are cheap enough to be used in coal mining cutters and rock drill bits. In fact, rock drill bits made by our company drilled over 3,500,000 feet of blast holes in the New York City water tunnel in the Catskills.

MOLYBDENUM

Of the four refractory metals, molybdenum is the "work horse." It is the most abundant and least expensive of the four. Authorities, including James J. Harwood of the Office of Naval Research, have called it the "most promising refractory metal."

Like tungsten, it dates back to the 18th Century, and again like tungsten, no use was found for the pure metal until Coolidge and Fink put it to work about 1910 for hooks and supports in incandescent lamps.

Molybdenum is somewhat more easily worked and fabricated than tungsten, and therefore finds uses in applications where tungsten would be too difficult to fabricate, or where the high melting point and high temperature strength of tungsten are not required.

The metal finds many uses in electronic tubes, and it was this market which attracted Fansteel into molybdenum production in 1915. It is sufficiently strong to retain its stiffness not only at tube operating temperatures, but at bombarding and outgassing temperatures. Anodes are easily fabricated from molybdenum sheet; grids and support members are made from wire. Seamless molybdenum tubing is commonly used for cathodes and supports. Rod is used for seals through glass.

Molybdenum wire is used for heating elements in industrial and laboratory furnaces where temperatures beyond the range of common resistance alloys are attained. Heat shields of molybdenum are often used to control or localize radiation, and small parts to be heated are often loaded into molybdenum "boats."

Molybdenum is used for electrical contacts, although not to so great an extent as tungsten. It is used not only in the pure state, but in composition with copper or silver. It is used as electrodes in mercury switches. It is readily wet with mercury, forming a good electrical connection; yet it does not amalgamate or react with mercury.

Molybdenum electrodes, usually made of large diameter rod, are used in glass melting furnaces. In this application, the molten glass acts as its own heating element while the electrode merely conducts current into the furnace. Molybdenum is used for this purpose because of its high melting point, its good electrical conductivity, and because the small amount of oxide formed does not appreciably contaminate or discolor the glass.

Sprayed coatings of molybdenum make a firm bond to steel and a number of other metals. At the same time, they provide an excellent surface for subsequent sprayed metal coatings. A common method of repairing a worn shaft is to spray a thin coating of molybdenum, then restore the shaft to desired diameter with sprayed steel. The molybdenum undercoating not only assures a firmly bonded finish coating, but eliminates the necessity of elaborate surface preparation such as knurling or grooving.

NIOBIUM or COLUMBIUM

When this paper appears in print, our next metal will be referred to as *niobium*, but most of those who use the metal, and most of us who make it call it *columbium*.

The columbium-niobium confusion took place between the years 1803 and 1844, and those who coined the names never saw any of the metal. Nobody, in fact, saw any of it until 1929 when Clarence W. Balke made it in the Fansteel research laboratory.

With a few exceptions, the uses of pure columbium as a pure metal have not been developed to a great extent because, generally speaking, the properties upon which uses are based are more characteristic of tantalum than of columbium. Another factor was the demand for columbium (in the form of ferrocolumbium) as an alloying constituent in stainless steel. There was little incentive for development of uses for a metal already in short supply.

The rather recent discovery of extensive deposits of columbium bearing minerals on the North American continent has justified exploration into additional uses of the metal.

Columbium is showing potential importance in nuclear energy technology, and as a material of construction where strength at high temperatures is required. These are new developments, but because of the far reaching implications, it may be expected that pure columbium, columbium base alloys, and other alloy systems containing appreciable amounts of columbium will become important commercial materials within a short time.

• • •

Most of the metal industries have a wide base of experience upon which to rely, in the published literature, in the number of men skilled in the art, and in the emphasis placed in collegiate curricula. The refractory metals industry, on the other hand, is operated by comparatively few specialists who, to a great extent, have developed their own technology and trained their own successors.

The availability of the refactory metals has been most important in industries where heat, corrosion, and abrasion pose problems. In fact, the importance of the refractory metals is perhaps substantially greater than the money volume of the business suggests. The demands of technology are for materials that will operate at higher temperatures. Since there is a relationship between the melting point of a metal and the highest temperature at which it still possesses satisfactory mechanical strength, the uses of the refractory metals may be expected to expand.

Further investigations may result in the discovery of properties which will lead into further uses. Examples are the anodic film properties of tantalum used in capacitors and the high transition temperature into the superconducting state which is characteristic of columbium. New uses may develop out of the high elastic modulus of molybdenum. Such discoveries will doubtless lead to further specific uses. The close association of the refractory metals with the electrical and electronic industries, both of which are growing at a healthy rate, is a positive indication of expanding importance.

Behind the scenes fight

Continuing Contest for Power in U.S.S.R.

A major continuing contest for power is now being waged behind the scenes in the Soviet Union, Professor Albert Parry of Colgate University said Nov. 16 in the first of the Graduate Lecture Series at Case Institute of Technology's Strosacker Auditorium. The struggle is between "the middle leadership" or Russia's new technical intelligentsia—engineers, scientists, managers—on the one hand, and Khrushchev's "upper leadership" or professional Communist bureaucrats on the other.

Not a publicized struggle at all, the process according to Dr. Parry can be deduced from a constant and careful study of private reports being brought from Russia as well as from a thorough reading of the Soviet press. "I consider the new Soviet scientists, engineers, and technicians that country's political wave of the future," Dr. Parry stated.

He declared that these technical intelligentsia are fully conscious of their role in recent Russian successes in rockets, missiles, and other progress in science and technology. "They are resentful of the loud effort of the Communist bureaucrats to claim credit for these achievements, to ascribe these successes to the Party," Professor Parry continued.

In one way and another the technical intelligentsia show their resentment and restlessness. Some, while members of the Communist Party, use their membership to oppose the bureaucrats in the daily routine of their jobs. Others disdain to hold Communist Party membership cards, and go unpunished. The Party now needs them more than they need the Party.

Khrushchev in his well-known shrewdness is aware of the developing phenomenon. He takes measures. He tries to man the most crucial of Russia's laboratories and launching pads with young persons whom he feels he can trust more surely than others. "He has sent his own young son Sergei to work in the field of rockets and missiles," said Dr. Parry, who is the author of the book *Russia's Rockets and Missiles*, published this week in New York. "He tries to safeguard his hold on the armed forces of Russia by not letting the country's younger military technicians assume high command posts."

As a case in point, Dr. Parry cited the personality of Russia's commander-in-chief of rocket forces. Until late October 1960 he was Marshal Mitrofran Nedelin, a man in his late fifties, an artillery soldier with hardly any special training in rocketry and missilery, but a staunch Communist Party member, with a seat on the Party's Central Committee.

On October 25 the Soviet government announced Nedelin's death in a plane accident, and the appointment of Marshal Kirill Moskalenko as his successor. The new marshal of rocketry has no special rocketry preparation for his new post. Now 60 years of age, Moskalenko is merely an oldtime infantry man. A Communist Party member since 1926, he was advanced in the Party's hierarchy simultaneously with his military promotions.

"A rocket expert who would be less of a Party man and more of a new-generation scientists-warrior could have been appointed by Khrushchev to this latest vacancy in Soviet rocketry, but was not," Professor Parry said. "The fact remains that Khrushchev and his Party oligarchs, while using such young military technicians intensively and skillfully, do not trust them for those top rocketry posts where they could make (or help make) policy. Henee the appointment of Moskalenko who, like Nedelin before him, is a zealous Party-line marshal, with even less of specific rocketry or other modern outer-space knowledge than the late Nedelin possessed."

Yet the tide of the new technical intelligentsia is strong and cannot be halted by Khrushchev completely. He finds such young faithful Communists as his son Sergei of little or no help. "Sergei Khrushchev is far more fond of collecting butterflies than of rocketry or any other sort of modern technology to be his father's sharp-eyed representative in that important field," the lecturer declared. "On his trip to the United States in September 1959, when Sergei accompanied his father on Nikita's initial visit to this country, the very first thing young Khrushchev did in New

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York was to seek out a butterfly-collection stores. And it was the last thing he did, too."

And the young military rocket men, so distrusted by Nikita Khrushchev, "did receive their rapid promotions recently in the Soviet armed forces," Professor Parry remarked, "despite the older generals' and marshals' displeasure and the big chief's distrust—even though these were promotions not to the top commands."

As examples of disdain shown by the technical or "middle leadership" for the bureaucrats or "upper leadership," Professor Parry cited various scornful epithets commonly used by Soviet engineers when, in their conversations, they refer to Communist functionaries.

Plebei

"The Soviet press, with much indignation at engineers, reveals that a favorite term of contempt applied by them at Communist bureaucrats is *plebei*, that is plebeians." Parry said as for the engineers' and scientists' attitude toward the Soviet dictator himself, "one recent private report is that at least some Soviet intellectuals know the truth about the crude behavior of Nikita Khrushchev last May in Paris and last September and October in New York. Their derogatory word about him, whispered among themselves, is *svinopas*, or 'swineherd.' In Russian this term has far more sneer and venom than the word 'swineherd' connotes in English.

Dr. Parry concludes: "In short, there is a new aristocratic, patrician feeling among such Russian intellectuals. They know that they are already above the country's lower middle classes, and above all the classes beneath the lower middle classes. But they want to be at least on a par with the bureaucratic upper classes, and if possible above the bureaucrats, too."

Dr. Parry is Professor of Russian Civilization and Language at Colgate University in Hamilton, New York, and Chairman of Colgate's Department of Russian Studies. A regular contributor to the Washington weekly journal *Missiles and Rockets*, on Soviet affairs, he is noted for his predictions of Russian rocketry successes made by him in the American press and in his lectures in 1953-54. Since 1958 Dr. Parry also has been a visiting lecturer and consultant at the U.S. Army War College.

Book for Graduate Student

A student's-eye view of how to get into—and through—graduate school has just been published by the American Society for Engineering Education, it was announced Nov. 7 in Urbana, Ill. Graduate study is becoming more important in engineering. Not every engineering student should take graduate study, but he should consider the possibility. "The Road to Graduate School" will give him the data to consider that possibility intelligently.

The new publication tells the engineering undergraduate about graduate study and the life of the graduate student. It was published by ASEE's Committee on the Development of Engineering Faculties. Publication was supported by the Ford Foundation. The new booklet gives the undergraduate a clear, objective picture of what graduate study is like, what its goals are, and what it requires of the student.

"The Road to Graduate School" was prepared by students in the University of Illinois chapter of Tau Beta Pi, engineering honorary society, and has the student's approach throughout. The aim of the authors was to give information that would apply to graduate study at any accredited engineering school in the United States.

The booklet is being distributed through engineering deans and individual chapters of Tau Beta Pi. It is available free to all undergraduate engineering students.

Illustrated by five photographs and four cartoons on graduate student life, "The Road" presents 20 pages of the most essential information for planning graduate study, including the reasons for taking graduate work, the kinds of degrees available, and the life of the graduate student. One section deals with what graduate study requires of the student, and another tells how to go about choosing the right school for the individual student's needs. The section telling "when and where to apply for what" is followed by a calendar for applications and inquiries that should help the prospective graduate student meet all the necessary deadlines.

For the married student there is a section on married housing, jobs for the wife, and similar problems that he may have to solve.

A detailed section on financial support outlines the types of support available and the advantages and disadvantages of each. This section makes the point that the engineer who is qualified for graduate study should have no trouble getting financial assistance if he needs it.

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Graduate Student" is the last section of the booklet. It provides an annotated list of references for the undergraduate who wants more information about graduate schools, financial aid, and other aspects of graduate study.

The entire booklet is what its title suggests—a brief, direct, inclusive map for the road to and through that interesting region, graduate school.

Aerosol Cleaners

Aerosol products now can be used to wash hands and throats, according to *Chemical Week*. The hand spray is said to cut through ink, oil, grease, paint and stains without water or scrubbing. The oral spray is for medicine, mouthwash and breath freshening.

Radioactive Water Made Safe

Three methods of removing radioactive contaminants from drinking water supplies have been successfully tested by the U. S. Army Corps of Engineers.

The Sanitary Engineering Branch of the U. S. Army Engineer Research and Development Laboratories, Fort Belvoir, Va., reported favorable results using a standard purification unit consisting of chemical coagulation and diatomite filtration which the Engineers call an "Erdlator," a mobile ion exchange unit, and an electrodialysis demineralization process.

Tests were conducted at the Nevada Test Site within proximity of the area where the atomic bombs were formerly tested. The Office of Civil Defense Mobilization participated in all the tests.

Radioactive soil specially ground to a very fine particle size to simulate radioactive fallout was added to a water source giving a contamination level of 660,000 units (micro microcuries per liter). After treatment in the "Erdlator" the contamination was reduced to 5000 units. This is less than the 300,000 units which is considered a safe emergency drinking water tolerance. The contaminated soil, was essentially insoluble in water and thus the "Erdlator" water treatment process, which is designed to remove suspended material from water, was very efficient.

Because some radioactive materials are also soluble in water, tests were conducted with specially prepared contaminants 100 per cent soluble in water. Strontium 90 and yttrium 90 were dissolved in the water source giving a contamination level of 1,800,000 units. To reduce these contaminants to an acceptable drinking level, treatment with the ion exchange unit was required as a follow-up to the Erdlator treatment to produce a finished water of 830 units. These tests were repeated, using almost one curie of soluble Cesium 137 with contamination of the water source to 12,700,000 units. The "Erdlator" and ion exchange treatment in series reduced the level to 2000 units. Cesium 137 contaminated water was also treated in the electrodialysis process which consistently produced a drinkable water of approximately 12,000 units.

Coagulation, filtration

Other water treatment processes tested included chemical coagulation followed by a sand filtration similar to municipal type filters, and a resinous water softening process which was typical of many home water softeners. The performance of the sand filter was equal to the diatomite filter in removing the insoluble contamination and the home softener was found capable of removing approximately 90 per cent of the soluble strontium 90.

An important part of the field tests was to measure the radioactive build-up in the equipment, especially those sections in which the removal process con-

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centrated the contaminant. Results indicate, that in the continuous flow systems not requiring constant operating attention and with the levels of contamination handled in these tests, an operator can satisfactorily perform his duties without special personal shielding. Furthermore, the bulk of all the equipment was satisfactorily decontaminated so that it could be reused.

Dual functions

Both the ion exchange and electrodialysis processes have dual functions as water treatment equipment. In addition to their water decontamination capabilities, they were tested at the site for the demineralization of a brackish ground water supply. Each unit at design capacity reduced the dissolved mineral content of a deep well water supply to the level acceptable according to current drinking water standards.

The ion exchange process used in these studies was a self-contained unit mounted on a standard 2½-ton truck chassis recently developed for military field service. Installed in the truck van body are conventional ion exchange pressure filters containing synthetic ion exchange resins which, when chemically exhausted, are regenerated in the field for further service. The electrodialysis process was a commercial type experimental unit modified for field operation. The unit consisted of a stack of selective ion exchange membranes to which electric power from a field generator is imparted to furnish energy for removal of dissolved ions from water.

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Technique Recovers Potable Water From Saline Source

A new technique has been developed for recovering potable water from the sea or other saline source, according to a report presented to the American Institute of Chemical Engineers in Washington, D.C. on Dec. 6.

The process is a new application of the Vapor Reheat principle. It was described by D. F. Othmer, R. F. Benenati, and G. C. Goulandris, of the Polytechnic Institute, Brooklyn 1, N. Y.

The Vapor Reheat process minimizes the energy and equipment requirements in the flash evaporation of sea water. "The technical feasibility and economic desirability of this process has been indicated for production of potable water from saline or brackish water."

Process "heats sea water . . .

This process "heats sea water after deaeration to an elevated temperature and then cools it by flash evaporation in a cascade of flash stages, at successively lower pressures. The concentrated brine discharges from the bottom or low pressure stage. A stream of distilled water chilled by the sea water enters the bottom stage as a spray or film. Free passage of vapor is allowed from the flashing brine to the large surface of the spray or film without mixing of the two liquid streams.

"The distilled water stream is heated by the condensation of the vapor and is pumped from each stage to the next higher one; and thus it passes countercurrent to the brine stream. It is constantly augmented by the condensate and reaches a maximum at the top or hot end of the cascade. An amount of distilled water, equal to the flash steam condensed in all of the stages is withdrawn as product; and the balance is recycled through a heat exchanger which transfers heat to the entering sea water. A second or prime heat exchanger using heat from the boilers heats the sea water to the highest temperatures, i.e., that of sea water entering the top flasher. Both exchangers are of either standard tube and shell type or of a special liquid-liquid type without metallic heat transfer surfaces."

Thing it Is the Proper to do?

NOTE: This column deals with standards of conduct in the engineering field. The editor invites comments and criticisms on the ethical problems considered herein. Questions submitted on engineering ethics will be given careful attention. You should address your letter: The Editor, Midwest Engineer, 84 E. Randolph St., Chicago 1, Ill.

Questions from the Readers: "Can a licensed electrical contractor be his own professional engineer?

The contractor in question has a B.S. in Electrical Engineering, but did not take the state examination for a professional engineer's license. Now his health does not permit him to run his electrical business and to take a refresher-course in electrical engineering at the same time."

Question: "What can be done?"

Reply: If the contractor is practicing engineering without a license for a Registered Professional Engineer, he is violating the Law of the State (assuming the state in which the contractor is doing business has enacted a "Professional Engineering Act"). The contractor, having the welfare and safety of the public in mind, should engage a Licensed Professional Engineer to take the responsibility for the design and installation.*

*An opinion of the Panel on Engineering Ethics of the Division on Education and Research of the Western Society of Engineers.

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X-Ray Diffraction Lab New I.I.T. Addition

A new x-ray diffraction laboratory, to be used for research and student instruction, is a recent addition to the metallurgical engineering department of Illinois Institute of Technology.

Used to determine the atomic structure of materials, the facility can serve as a means to forecast the strength and durability of various metals. Equipment of this type has also been utilized in uncovering the properties of materials and new methods to facilitate manufacture of intricate solid-state devices such as transistors.

The laboratory houses a micro-focus unit and four basic x-ray units, two diffractometers, a single-crystal and a double-crystal spectrometer, various single crystal and powder cameras, a liquid-nitrogen cryostat and miscellaneous auxiliary equipment.

Research currently in progress in the laboratory includes crystal structure analysis, absorption-edge fine structure, alloy formation, crystal perfection, crystal growth, and recrystalization studies.

Activities in the new laboratory are under the direction of Dr. Leonid V. Azaroff, associate professor in Illinois Tech's department of metallurgical engineering.

Prestressed Is Ok'd

The International Conference of Building Officials has formally approved the inclusion of prestressed concrete into the Uniform Building Code, one of the four model codes used in the United States, Norman Scott, executive secretary, Prestressed Concrete Institute, Chicago, announced on Oct. 27.

The Provisions of the Code relating to prestressed concrete construction were first approved by the Structural Engineers Association of California and were formally adopted for inclusion in the Uniform Building Code by the International Conference of Building Officials at their recent convention in Colorado Springs, Colorado.

The approval was based on a reason simply stated by the Conference that "prestressed concrete method of design provides adequate safety based on procedures to be included in the Uniform Building Code Standards, Volume 3."

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Reviews of Technical Books



The McEachern Story

The Daniel V. McEachern Story, by Dr. E. C. Nance, published by The College Press, College Place, Wash. Pages, 246.

This book about Dan McEachern and his General Construction Company of Seattle tells the story of a Scotch-American boy born in Michigan in 1879, raised to the age of 10 in North Dakota, and grown to manhood in Seattle, Washington. With his brothers John and Frank, he organized the J. A. McEachern Company in 1911. Fifteen years later the company joined General Construction Company of Spokane to get the $3 million contract for Owybee Dam in Oregon, and in 1932 the McEachern brothers bought General and merged their company with it.

For the past quarter century General Construction Company has appeared wherever big jobs have been done. Some jobs involved have been Parker Dam, the Colorado River Aqueduct, Bonneville Powerhouse, Grand Coulee Powerhouse, Ross Dam, Tacoma Narrows Bridge, Anderson Ranch Dam, and Hungry Horse Dam.

The McEachern Story gives some interesting philosophies on life and the construction business.

Structural Mechanics

Introduction to Structural Mechanics, by Paul Andersen and Gene M. Nordby. Published by The Ronald Press Company, New York 10, N. Y. Pages, 340. Price, $9.50.

The authors of this work stress that structural design, as an art, must be built upon a firm scientific foundation. Their book develops a sound basis for the solution of the structural problems which the engineer encounters in practice. The basic theory is applied not only to traditional structures, such as roof trusses and bridges, but also to aircraft structures and machine design. It develops theory largely through practical design problems.

Emphasis is placed upon understanding the stability of a truss. Methods of analysis are presented for simple, compound, and complex trusses. The concept of the influence line is introduced and discussed—its essential character and its applications. The effects of moving loads on structures are also included. Each chapter covers a specific subject which adds to the continuity of the text in the event a chapter is skipped.

General methods are stressed rather than techniques of limited application. Graphic statics is extended to problems more complicated than those met in courses in mechanics. Extensive coverage is given to three-hinged arches and treatment of space truss structures, evolving from German and French research are explained.

W.L.R.

Feedback Control

Analysis and Design of Feedback Control Systems, by George J. Thaler and Robert G. Brown. Published by McGraw-Hill Book Company, New York 36, N.Y. Pages, 648. Price, $14.50.

Formerly entitled *Servomechanism Analysis*, this text has been completely rewritten to bring both the presentation and the material up to date.

The book is intended as a text for a first course in feedback control theory at either the senior level or at early postgraduate level. The importance of automatic controls has grown tremendously in almost every field of technical endeavor. The normal advances in theory and practice have been greatly accelerated by the high performance requirements of military equipments using automatic-control systems. In many instances combinations of hydraulic, pneumatic, mechanical, and electrical components were required to meet the performance needs. New design methods had to be developed to meet the requirements for precise automatic controls.

Numerous components of automatic-control systems are discussed in detail showing the relative merits and advances of each system. The mathematical equations that apply are explored and methods and analysis of design are thoroughly elucidated. Helpful features that have emanated from feedback control research are also incorporated in this extensive volume.

In addition, the principles discussed and emphasized in the various chapters of the text are The Laplace Transformation, Equations of Physical Systems, Transient Analysis of Servomechanisms, Transfer Functions, Graphical Representation and Manipulation of Transfer Functions, Application of Design Principles, Mitrovic's Method for the Analysis and Synthesis of Feedback Control Systems, Phaseplane Analysis of Nonlinear Servos, and Relay Servomechanisms. The appendixes also include Nichols Chart and Tables, Error Detectors, Controllers, Servomotors and Compensating Devices.

W.L.R.

Airport Concrete Pavements

Design of Concrete Pavements for Airports, prepared under the direction of the Technical Committee, Wire Reinforcement Institute, Incorporated, Washington 4, D. C. Pages, 96. Price, $3.00.

This handbook has been prepared in the form of a manual to serve as a reference for engineers responsible for the structural design of concrete pavements. It presents the design criteria and practices that have been adopted by airport construction agencies.

The book is intended to provide the design engineer with essential data for preparing a detailed set of construction plans for reinforced concrete pavements. Drawings and tables have been included to reduce tedious calculations to a minimum.

Also included are these major topics: basic factors in design; concrete pavement design fundamentals; subgrade; subbase and drainage; pavement thickness; reinforcement; concrete overlays; advantage of reinforcement; and welded wire fabric data. Numerous layout sketches and photographs of actual job conditions help to illustrate proper construction practices.

W.L.R.

Applications

Francis G. Swies, Equipment Engr., Western Electric Co., Inc., Merchandise Mart Plaza.

Maurice Fulton, President, Fantus Factory Locating Service, 1820 Prudential Plaza.

Boleslaus F. Przybycin, Senior Plan'g. Engr., Western Electric Co., Inc., Hawthorne Station.

Fingerprinter

An electronic optical system that catches and records fingerprints without smearing fingers with ink or other chemicals is now on the market, *Product Engineering* reports. A gentle touch of the finger on a small glass plate is all that's necessary for the system to produce a clear, distortionless print.

CTA Makes History on Nov. 6

Chicago Transit Authority made transit history again on November 6 when it placed in operation a new train-phone system on its North-South rapid transit route to enable direct communication between Operations Control in the Merchandise Mart and the motormen of trains on the road.

CTA's North-South route, extending from 63rd Street and Stony Island Avenue and from 63rd Street and Loomis Boulevard on the south side to Howard Street on the north side, carries about 360,000 passengers on an average weekday. This volume is equivalent to 65 per cent of CTA's daily total of rapid transit passengers.

This is the first time that a train-phone system has ever been installed for regular daily use on an urban transit system, according to Walter J. McCarter, CTA General Manager.

With this new train-phone system, the motorman of an in-service train can report instantly and directly to Operations Control in emergencies such as illness of a passenger, equipment failure, a disturbance or other situation which causes delays and gaps in service.

The Superintendent of Operations Control can then give directly to the motorman specific instructions for prompt, corrective action, and arrange for the necessary assistance in overcoming the emergency. He can also issue operating instructions to the motormen of other trains so that the over-all effect of an emergency situation on service along the entire route may be minimized.

(Continued on page 24)

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News of Engineers

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Western Society member **Theodore W. Van Zelst,** president of Soiltest, Inc., Chicago recently visited Europe to meet with Soiltest's sales representatives in a number of countries. He lectured at several Belgian universities, giving engineering and student groups information on new developments in the field of engineering testing.

Soiltest, manufacturer of engineering test apparatus for soils, concrete, asphalt and similar construction materials, has a subsidiary corporation, Soiltest International S.A. with headquarters in Lausanne, Switzerland. This European office handles the sales and distribution of the company's products in Europe, the Middle East and Africa.

•

Seven recent faculty appointments at Illinois Institute of Technology have been announced by **John T. Rettaliata,** IIT President and Past President of the Western Society, making a total of 32 new additions to the teaching staff.

Former president and chief engineer of a firm doing research in aerodynamics, propulsion and space flight, Dr. Irving Michelson has been named professor of mechanical engineering and placed in charge of the aeronautics laboratory of the mechanical engineering department. Directly before coming to IIT, Dr. Michelson was professor and director of Pennsylvania State University's department of aeronautical engineering.

R. Ogden Hannaford was appointed as an associate professor in the IIT department of architecture. He is a registered architect in the states of Illinois and Iowa, and holds a certificate from the National Council of Architecture Registration Boards. Hannaford, who has been active in the field of architecture since 1947, received a B.S. degree in architecture from Illinois Tech in 1947, and received a B.A. degree in history of architecture from Yale University in 1939.

Additions to the electrical engineering department as assistant professors are Lester C. Peach and Paul C. Yuen, 3101 S. Wabash av.

Peach recently fulfilled the requirements necessary to receive a Ph.D. degree from IIT, but is awaiting conferral of the degree. He received his B.S. degree from the University of Chicago in 1948. Before joining IIT, Peach worked as an engineer in the industrial and research fields.

Yuen was awarded his bachelor's degree at the University of Chicago in 1952, and won both his master's and doctor's degrees at IIT in 1955 and 1960, respectively. He also worked in the industrial engineering field before joining the IIT faculty.

A former University of Wisconsin teaching and research assistant, Thomas L. McCoy was named instructor in IIT's mathematics department. He received his B.S. degree from Oberlin College, Ohio, in 1954, and his M.S. from University of Wisconsin in 1956. McCoy is presently a candidate for a Ph.D. degree from the University of Wisconsin.

Named English instructor in the language, literature and philosophy department was James R. Ford, a 1955 graduate of Williams College bachelor's degree program. Ford received his master of arts degree from the University of Chicago in 1956.

John T. Ritter, 501 E. 32nd st., was appointed as an instructor in the IIT physics department. Ritter, now working on a graduate degree at IIT, was awarded a bachelor's degree at the Uni-

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versity of Tulsa, where he had been a laboratory instructor.

•

M. O. Buehring, director of sales, Simpson Electric Company, has announced the appointment of Leroy E. Tice as chief field engineer. Tice will serve as technical adviser to the sales department and its representative organization, and will also serve as engineering laison to the customer in the original equipment market.

Mr. Tice formerly was with Cook Electric Company where he served as staff engineer and section director of the instrumentation and Field Test Section. Here he headed many government and industrial projects which included: a data reduction system for the outer atmosphere study program, a multi channel recorder for doppler positioning, and an airborne dew point indicator.

•

Robert E. Bergmann has been named assistant plant manager of the Des Plaines, Illinois manufacturing installation of the Benjamin Division of Thomas Industries Inc., Louisville, Ky.

The announcement was made by John Beam, executive vice-president of Thomas Industries, the world's largest manufacturer of commercial, industrial, and residential lighting fixtures through its Benjamin and Moe Light divisions.

In his new position, Bergmann reports directly to George Hamm, who is the overall plant manager of Thomas Industries' Des Plaines manufacturing installation. The Benjamin division manufactures commercial and industrial lighting fixtures.

Bergmann joined the Benjamin division in July of 1959 as personnel director, and had various assignments in industrial engineering and production control from April of 1960 until appointed to his present position.

Since his graduation from Purdue University in 1950 with a degree in Mechanical Engineering, Bergmann has had a varied industrial career. He spent a year as a project engineer with Swift & Co.'s Dairy and Poultry division. He next was called into the Army's Chemical Corps as a project engineer for flame throwers and smoke generators.

Bergmann spent five years with the Minneapolis Honeywell Regulator Company in work involving engineering, personnel, customer service, production control, and various special projects. During this period he also received his masters degree in Labor Relations from Northwestern University. Prior to joining Benjamin he was assistant to the president of the Langdon Supply Company.

In addition to its Benjamin and Moe Light lines, Thomas Industries produces power blade saws through its Wright Saw division, and portable paint spray equipment through its Electric Sprayit division, both with manufacturing facilities in Sheboygan, Wis. Other Thomas Industries manufacturing facilities are located in Ft. Atkinson, Wisc., Los Angeles, Calif., Ft. Smith, Ark., and Toronto, Canada.

•

Norman A. Rautiola has joined the staff of Bjorksten Research Laboratories, Madison, Wis., as assistant to the executive vice-president. Rautiola, a graduate Metallurgical Engineer, obtained his master's degree in Business Administration and studied Law at George Washington University. He was previously employed as a Senior Patent Examiner in the fields of metallurgy and semi-conductors, by the U.S. Patent Office, Washington, D. C.

Kenneth A. Bouschart has also joined the Laboratories as a staff electrical engineer in the Physics Division. He is a graduate of the University of Wisconsin and was formerly with AC Spark Plug Company in their Milwaukee Inertial Guidance Systems Laboratory.

•

Karl-Heinz Achs, 609 Washington Blvd., Oak Park, has been named Special Assistant to Victor Adding Machine Co.'s Director of Engineering, Charles R. Strong.

Achs joins Victor from the position as Plant Manager of Janette Electric Mfg. Co. of Morton Grove.

A graduate of the Technical University of Berlin, Germany, in both Mechanical and Electrical Engineering, Achs has also served in the United States as chief industrial engineer of Kellogg Communication Division of International Telephone and Telegraph Corporation. He previously was attached to the

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parent organization in Brazil. He came to the United States in 1956.

The new Victor engineering executive is an associate member of the American Institute of Management and belongs to the American Society of Tool Engineers.

•

Two major administrative appointments in Northwestern University's Technological Institute — reflecting the school's increasingly important role in graduate engineering education and in independent scientific research — were announced by Harold B. Gotaas, Institute dean.

They are:

Robert B. Banks, professor of civil engineering, as assistant dean for graduate administration and research development, and,

Donald H. Whitmore, associate professor of metallurgy and materials science, as chairman of the Institute's materials science department.

In his new post, Banks will take charge of the school's efforts to secure extra research support from industry and government. He also will work to increase the number of graduate fellowships and assistantships available for engineering students.

Whitmore replaces Morris E. Fine as head of the school's fast-growing materials science department. Fine recently was named chairman of the new Northwestern Materials Research Center, formed last summer when the Defense Department's Advanced Research Projects Agency (ARPA) awarded a $3.4 million contract to the University.

Banks' appointment involves the sharp hike in volume of scientific research at the Institute—shown in the school's *Faculty Publications*, 1958-59, scheduled for early issuance. Compared to the previous two years, the number of published faculty research papers has doubled (from 111 papers to 226).

Banks' additional responsibility for graduate student administration is the result of Northwestern's new ranking in the granting of advanced engineering degrees. Last year the Institute awarded 24 doctorates, placing it eighth among U. S. schools.

Banks, first a student and then a faculty member in the Technological Institute, received the Ovid Eshbach award in 1947 as the outstanding engineering senior. (The late Dean Eshbach was a Past President of the Western Society.) He is a specialist in fluid mechanics, and spent the summer of 1960 at Space Technology Laboratories, Pasadena, Calif., doing research on problems of plasma propulsion, one technique proposed for space travel.

Whitmore in 1953 originally formed the school's metallurgy department, since renamed materials science. Currently he is engaged in research in semi-conducting and mass transport properties of metallic acids, and in gas-oxide reactions.

At the time of his new appointment, Whitmore reported that the faculty of the materials science department should double in size to 14, and the number of graduate students should double to 70, in the next five years. He said these increases are anticipated as the new Materials Research Center reaches full strength.

•

James B. Clow & Sons, Inc., Chicago manufacturer of cast iron pressure pipe, has purchased the Streator Drain Tile Company, Streator, Ill., for approximately $2,500,000, John Madden, Clow president, has announced.

The 53-year-old Streator company employs 200 people and produces 40,000 tons of vitrified clay sewer pipe, drain tile and other clay products annually. Operation will continue under Streator president, J. L. Tremper, as a third wholly-owned Clow subsidiary. Other Clow subsidiaries are Iowa Valve Company, Oskaloosa, Iowa, and Eddy Valve Company, Waterford, N. Y. Clow operates cast iron pipe plants at Bensenville, Ill., Coshocton, Ohio, and Birmingham, Ala. Clow's locally-based Jobbing Division is one of the largest distributors of plumbing, heating, and refrigeration supplies in the Midwest.

The Streator purchase is the second expansion move announced by Clow in 1960. Operation of a cast iron pressure pipe plant in conjunction with General Industries Ltd. of Melbourne, Australia, was announced in July. This plant is now under construction.

•

Four new assistant professors and a lecturer have been named to the civil engineering department of Northwestern University's Technological Institute, Harold B. Gotaas, Institute dean, has announced.

The assistant professors are;

Dr. John F. Fleming, specialist in structures and mechanics; Robert L. Kondner, soil mechanics; Jimmie E. Quon, sanitary engineering and air pollution; and Dr. Paul W. Shildiner, traffic and highway engineering.

The lecturer is John F. Ely, structures specialist, who also is director of the Institute's truss bridge project in Evanston.

Dr. Fleming's interest centers in mechanics and structures, and the application of electronic digital computers to research in these areas. He received his doctorate this summer from Carnegie Institute of Technology, Pittsburgh.

Kondner since 1956 has handled the teaching, sponsored research and graduate research in soil mechanics at Johns Hopkins University, Baltimore. Kondner received his bachelor's and master's degrees at that school, and expects to receive his doctorate from Johns Hopkins this winter.

Quon, a specialist in air pollution studies, received the Legge award as outstanding student in industrial hygiene and atmospheric pollution, presented

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earlier this year by the Northern California section of the Industrial Hygiene Association. He received the award for his work while studying and teaching at the University of California, Berkeley. He expects to receive his doctorate from that school in January.

Dr. Shildiner, a specialist in traffic and transportation engineering, also attended the University of California, Berkeley, and received his doctorate there. He then went to Europe on a National Science Foundation fellowship to study city and regional planning.

Since 1956 Ely has directed Northwestern's big truss bridge project, involving a half-million dollar 100-ft. steel test bridge. It is believed to be the largest ever made in which members can be loaded to destruction in analyzing their behavior. Northwestern researchers hope to learn how to design steel bridges more efficiently as a result of their work. Ely was recipient of a Cabell Fellowship at Northwestern last year. He hopes to complete work for his doctorate in theoretical and applied mechanics at Northwestern next year.

•

Valve sales and engineering have been brought together under one department in Republic Flow Meters Company, subsidiary of Rockwell Manufacturing Co., and two key department appointments have been made.

Albert J. Rosenberger, formerly chief mechanical engineer, was appointed manager of the new valve sales and engineering department. William R. Robinson, former manager of Republic's St. Louis district office, was appointed valve sales supervisor.

The move was made "to better coordinate technical service to customers," according to Tom Bell, general sales manager.

Republic Flow Meters is a leading supplier of instruments and controls for large steam plants, chemical processes, and steel and paper mills.

•

New chairman of the chemical engineering department in the Northwestern University Technological Institute is George Thodos, professor of chemical engineering and an institute faculty member since 1947.

The appointment was announced by J. Roscoe Miller, University president.

Dr. Thodos has been active principally in chemical engineering research, and has published nearly 50 papers in his 20-year career. His specialty is petroleum technology.

His current work at Northwestern is supported by grants from the National Science Foundation, through the petroleum research fund of the American Chemical Society, and from the office of scientific research of the U. S. Air Force.

Thodos came to Northwestern in 1947 as assistant professor, and rose to full professor in just six years. Before 1947 he worked for Phillips Petroleum and Pure Oil, after receiving his doctorate in chemical engineering at the University of Wisconsin in 1943.

•

Soiltest, Inc., Chicago manufacturer of engineering testing apparatus has announced the appointment of Robert N. Manatt as Director of International Sales.

Mr. Manatt is a graduate of The College of William and Mary and The American Institute for Foreign Trade. He was formerly on the staff of Iowa Wesleyan College.

Did You Know?

Round radios that can be hung on the wall are being brought out by a Japanese firm, according to *Product Engineering*. The transistorized radio looks like a kitchen clock, weighs five-and-a-half pounds, and has two speakers.

•

Surgeons now can read several indicators of a patient's condition on a wallboard during an operation, says *Control Engineering*. With the device, a surgeon can tell at a glance the patient's blood pressure, temperature and respiration.

United of America Now 14 Floors High

American Bridge Division of United States Steel Corporation has reached the 14th floor level in erection of the 7,000 tons of steel framework for the 41 story United of America skyscraper at State street and Wacker Drive.

The $22 million office building will contain many of the most modern applications of steel. It is estimated that the steelwork will be topped out about March 1.

Shaw, Metz and Associates are the architects; A. L. Jackson & Co., is general contractor, and L. J. Sheridan & Co., are rental agents.

Among the unusual applications of steel in the building are the use of U. S. Steel's "Man-Ten" high-strength steel in the columns for the three basements and the first 23 floors. Use of "Man-Ten" saved $45,000 in the cost of the erected frame by reducing the weight of the structural steel. Conventional carbon structural steel will be used in the upper floors.

Stainless steel angles will be used to support the white marble on the face of the structure. Another U. S. Steel product, "Cor-Ten" steel, was used in the fuel tanks in the basement.

The building is being built by the United Insurance Company of America for its central office and the company will occupy many floors in the building. The site fronts 181 feet on Wacker Drive and 140 feet on State street. The structure will be the first office building to be erected on the east-west section of Wacker Drive in more than 30 years. The building will tower 525 feet above street level, making it one of the city's

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tallest buildings. It will have a gross area above the first floor of 695,000 square feet with a net rentable area of 500,000 square feet.

The building—the world's tallest marble office structure—is scheduled to be completed in August, 1961.

Much of the steel for the building has been rolled at the Corporation's South Chicago Works and is being fabricated at the American Bridge plant in Gary, Ind.

Another unusual feature of the steel erection lies in the fact that three-story columns are being raised at one time instead of the conventional two.

Steel for the building is shipped by rail from Gary to a storage area in the Illinois Central Railroad yards on the south bank of the Chicago river, east of the Michigan avenue bridge, then shipped to the site and readied for erection. A giant derrick lifts the columns one at a time. Horizontal beams are bolted to the vertical columns.

So that sidewalk superintendents can keep abreast of construction, American Bridge will display an 8 x 12 foot sign on the highest steel showing in huge numerals the present height of the building.

The American Bridge erection crew is under the direct supervision of G. W. "Tex" Twining, who supervised the erection of the steelwork for the Prudential building. Other American Bridge officials working on the United project are George R. Carter, construction manager in Chicago; Frank Sedlacek, assistant to the construction manager; Western Society trustee Philip J. Larson, regional contracting manager; Western Society member M. D. Corner, district contracting manager; and Richard Ellsworth, contracting manager.

CTA Makes History

(Continued from page 19)

Whenever the occasion warrants, the Superintendent of Operations Control may also broadcast messages direct to the passengers of any train that may be involved in an emergency situation.

Seventy fully transistorized, portable train-phones for the installation were purchased from Femco, Inc., of Irwin, Pennsylvania, for $54,920. The total cost of the installation approximates $123,000. Each portable unit is a frequency-modulated power carrier, about 17″x 12″x 6″ in size, and weighs about 16 pounds.

In transmission, a motorman's voice, for example, is converted to an FM radio signal and carried through the third rail power distribution system. At intervals of approximately one mile, the FM signal is "tapped off" and fed into a telephone cable on the track structure which connects a wayside transmitter-receiver station where the FM signal is again converted to voice impulses and fed into telephone lines leading to the Operations Control room in the Merchandise Mart. The reverse of this procedure occurs when the Superintendent of Operations Control is transmitting.

When the Superintendent of Operations Control desires to talk to a motorman of a particular train, he picks up the telephone-type hand-set of the central office control console, presses a button in the handle of the hand-set, and calls the motorman by his train run number. When a motorman on a train wishes to communicate with the Superintendent of Operations Control, he lifts his hand-set, presses the button, and talks.

The train-phone communication system supplements CTA's central supervisory control system which was introduced to the transit world by CTA in 1951 and is now in use on all seven of CTA's rapid transit routes. Ultimately the train-phone system is to be extended to the six remaining rapid transit routes.

CTA has made transit history in recent years by the introduction of lightweight, fast-accelerating rapid transit cars, and high-speed, high-performance rapid transit cars; the first experimental installation of a recently developed electronic method of recording intervals between in-service buses; and the integration of rail rapid transit in the right-of-way of the Congress Expressway.

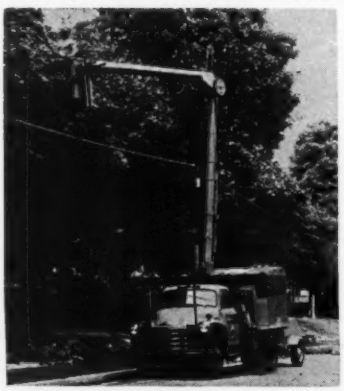
Pretty Fair Radio

A fair-weather transistor radio, powered by a solar battery like those used to operate equipment in many space satellites, is being marketed on an experimental basis by a Japanese firm, reports *Electrical Merchandising Week.*

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C-8356 PLANT MAINT. ENGR. Grad. ME, CE or EE age to 45; To inaugurate at office level maint. program for multi plant operations involving budget maint., preventive maint. programs, etc. for process industry. Will be indoctrinated in company's policy for abt. 2 yrs. in Chgo. then assigned to a district as area maint. supv. Must have good personality sal. $9/13,000 dep. on exper. loc. Chgo., employer will negotiate the fee.

C-8361 ELECTRONIC ENGRS. Grad. Elect. with electronics option; Analysis of circuitry for radar control. Must be U.S. citizen & able to get security clearance. Present assignment is a temporary one abt. 3 mos. may have other work at the end of that time. 100 miles west of Chgo., for a consultant sal. up to $1500 mo. + per diem allow.

C-8381 (B) PROJECT ENGRS. & DESIGNERS Reciprocating Compressors BSME or equiv. 5-10 yrs. exper. with reciprocating compressors. Under Gen'l. supv., plans, conducts & supv. assignments. Estimates manpower needs & schedules work to meet completion dates & tech. specs. Coordinates & supv. activity of design engrs. & draftsmen; maintains liaison with mfg. & product depts.; reviews progress & evaluates results; makes changes in design; where nec. Gen'ly. operates with appreciable latitude of action or decision, sal. $8/10,000 loc. No. Ind., employer will pay the fee.

ENGINEERS AVAILABLE

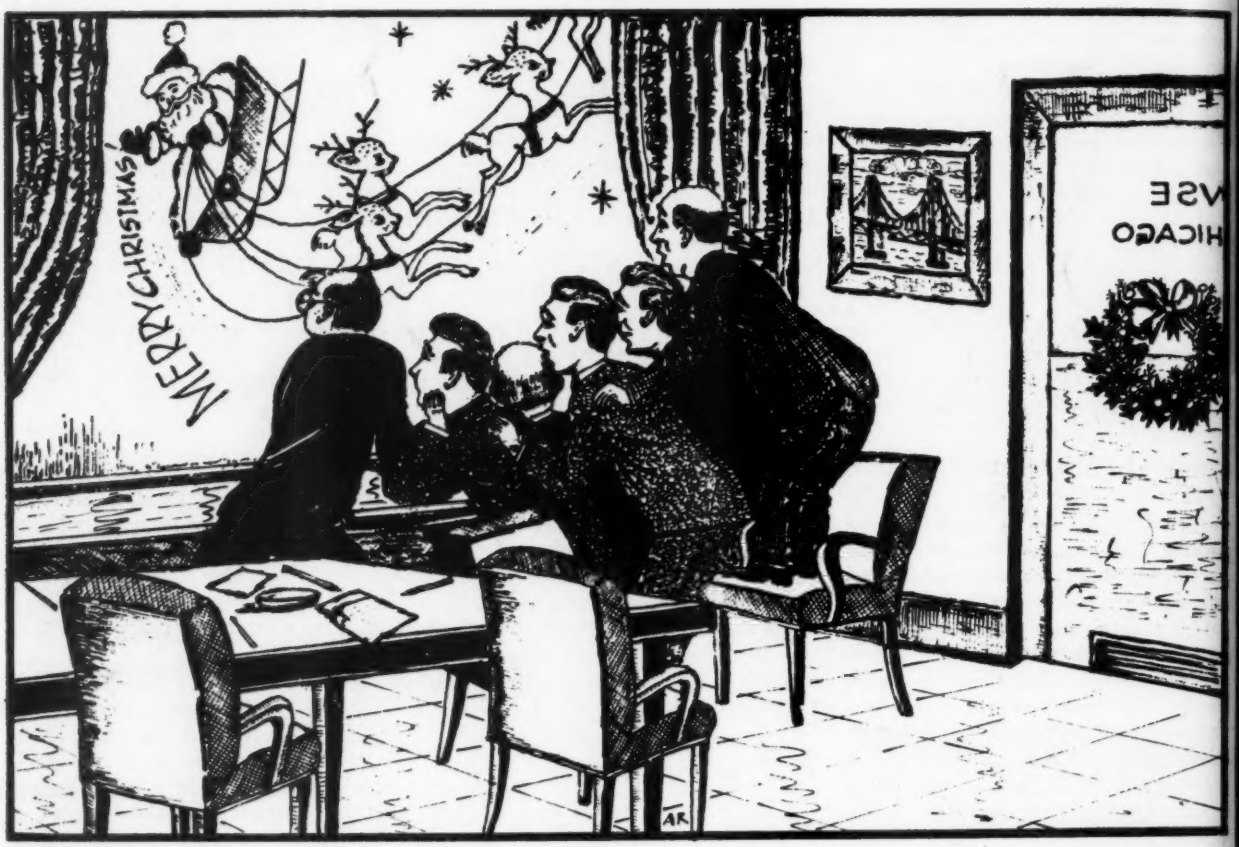
ASST. CHIEF ENGR. BSME 56; Chief Engr. non-metallic gaskets 8 yrs. wide exper. in materials engrg., customer contacts & policy making of sales-mfg. activities, sal. $12,000 loc. Chgo. (MW-306)

DIRECTOR OF ENGRG., CHIEF ENGR. MSME 32; 12 yrs. exper. 5 yrs. research & devel., gas turbines, aircraft & missile components. Exper. in engrg. mgmt., product planning, supv., customer contacts. Broad engrg. background. sal. $14,400 loc. U.S. & Foreign. (MW-307)

INDUSTRIAL MGMT. ENGR., BSIE 34; 11 yrs. exper. Cost reduction, methods & performance improvement, engrg. economy studies, production facilities planning & layout, budgetary control, production control, administration, purchasing, supv. sal. $8400 loc. Chgo. Area. (MW-309)

CHIEF, PROJECT OR APPLICATION ENGR. BSME 46; 20 yrs. exper. 6 yrs. as chief engr., exper. in design, product devel., ferrous metallurgy, mfg., bldg. construction, quality & cost control, customer applications in forging, heavy machinery & railroad trackwork fields, excellent record, four patents. Sal. & loc. Open. (MW-310)

PRODUCT ENGR. BSME 40; 16 yrs. exper. familiar with wide range of engrg. problems from exper. of design, preparing & issuing of drawings & parts lists & following them thru production, sal. $9500. (MW-311)



Fellow Members:

Your Membership Committee wishes you Merry Christmas and Happy New Year. We hope that the New Year will bring new efforts in the direction of strengthening our membership.